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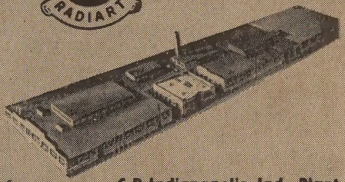

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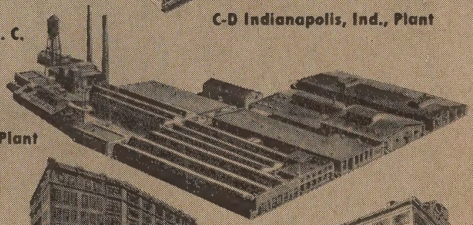

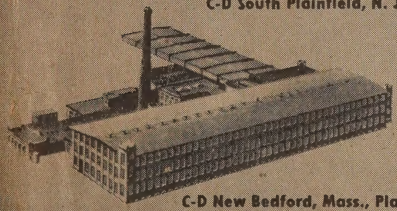

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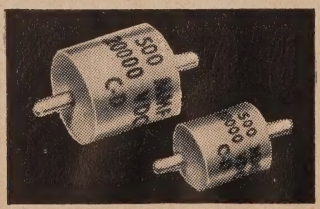

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TIME-DELAY CIRCUITS

When a d. c. voltage is applied to a capacitor, charging current flows into the capacitor. This current continues to flow until the capacitor becomes fully charged, whereupon it ceases. When a d. c. voltage is applied to an inductance, the counter electromotive force produced by lines of force in the coil at first opposes the passage of current. But as the counter e. m. f. is overcome, current flows and eventually reaches a maximum value, whereupon it continues to flow at that level.

If a resistance is connected in series with the capacitor or inductance, it will prolong the decay of current in the capacitor circuit or the growth of current in the inductor circuit. The higher the resistance value, the greater will be the lapse of time between the application of voltage and the instant at which capacitor current reaches zero, or between the application of voltage and the instant at which coil current reaches maximum.

If a capacitor is charged from a d. c. voltage source and then is connected in parallel with a resistance, the capacitor will discharge through the resistance. The discharge current flowing through the resistance will start at a maximum value and will decrease until the charge has been dissipated, whereupon the current will cease to flow. The time required for the discharge current to decrease from its maximum value to zero depends upon the resistance value, being long in the case of a high resistance.

The simple electrical operations explained in the three preceding paragraphs form the basis of a variety of *time-delay circuits* employed in electrical and electronic devices. In resistance-capacitance circuits, the product RC (resistance in ohms, and capacitance in farads) expresses the number of seconds taken for the capacitor current to drop to 37 per cent of its starting value. In resistance-inductance circuits, the quotient L/R (inductance in henries, and resistance in ohms) indicates the number of seconds required for the inductor current to increase to 63 per cent of its final value. RC and L/R are termed **time constants** of the circuits to which they apply. By proper selection of C, L, and R values, any desired time constant may be obtained.

Figures 1 to 5 show basic R-C and L-C timing circuits. In Figure 1, when the switch is closed, current flows from voltage source E and charges capacitor C through resistor R. The exponential decay of current in this

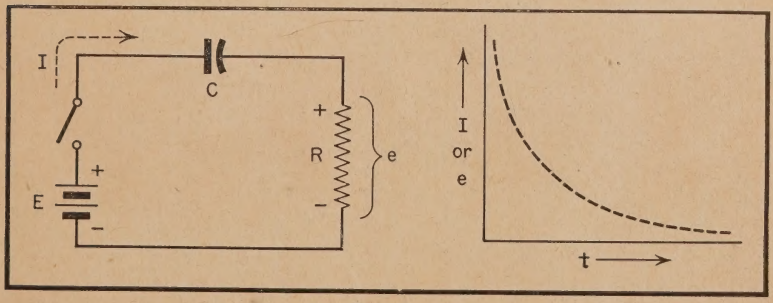

Fig. 1.

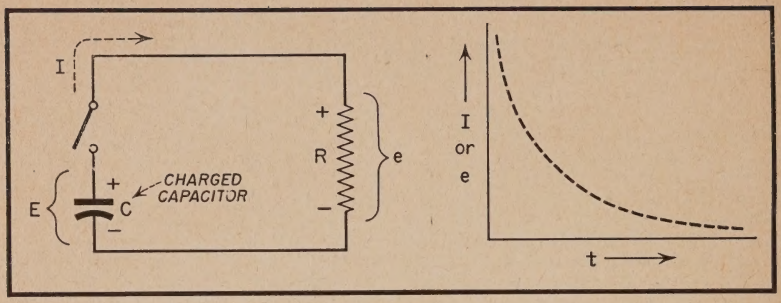

Fig. 2.

circuit is depicted by the accompanying curve. This curve also expresses the decrease of voltage drop **e** across resistor R. While voltage **e** and current I are decreasing, the voltage across the capacitor is rising exponentially in the reverse manner, reaching a maximum value when **e** and I are at their minimum values. This arrangement is useful for starting an operation, such as picking up a relay, and having the controlled device hold until a predetermined time when it is dropped out. A high-resistance controlled device receives its operating voltage (e) from across resistor R. A current-operated device may be connected for operation in series with R and C.

In Figure 2, capacitor C is charged to voltage level E from an external d. c. source. When the switch is closed, the capacitor begins to discharge through resistor R setting up a voltage drop, e, across the resistor. Discharge current I and voltage drop **e** have a maximum starting value but both decrease exponentially with time, as depicted by the accompanying curve. When the capacitor has been discharged completely (at a time determined by the RC product of the circuit), I and **e** will become zero. This arrangement, like that of Figure 1, is useful for actuating a device when the switch is closed, and then having the device go out of operation after a predetermined time interval. This arrangement differs from the scheme of Figure 1, however, in that all voltage

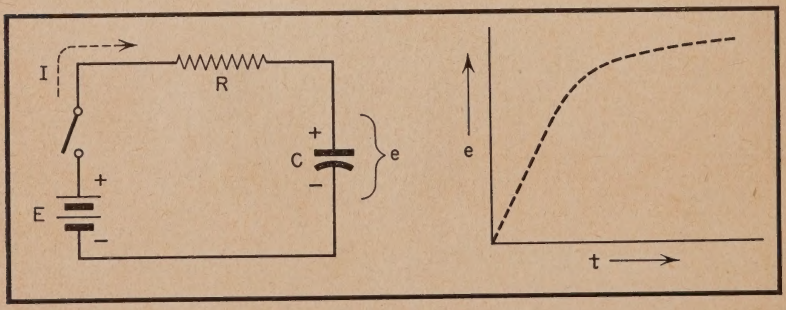

Fig. 3.

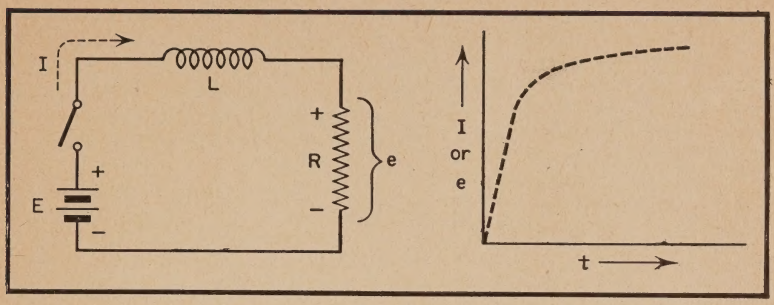

Fig. 4.

is removed automatically from the capacitor when the circuit goes out of operation. A high-resistance device to be controlled can receive its operating voltage (e) from across resistor R. A current-actuated device may be connected in series with R and C.

The circuit of Figure 3 is similar to that of Figure 1, except that the point of interest here is the voltage across the capacitor. When the switch is closed, current I flows from voltage source E and charges capacitor C through resistor R. As the charging process progresses (at a rate determined by the time constant RC of the circuit), voltage **e** across the capacitor increases exponentially until it reaches a final steady maximum value corresponding to full charge of the capacitor. The accompanying curve depicts this rise of voltage **e** with time. This arrangement is used when operation is desired at some time interval after a switch has been closed. A high-resistance device to be operated can receive its voltage from capacitor C.

When the switch is closed in the circuit of Figure 4, current I flows from voltage source E through inductor L and resistor R, rising to a maximum steady value in the time interval determined by the L/R time constant of the circuit. The voltage drop, e, across resistor R and the current, I, through the inductor increase exponentially with time in the manner depicted by the accompanying curve.

This scheme may be used when it

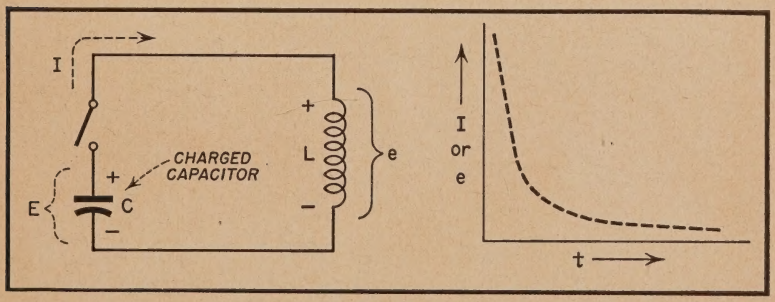

Fig. 5.

is desired to have a device operate at some time after the switch is closed and continue to operate until the switch is opened. A high-resistance device to be operated can receive its voltage (e) from across resistor R. If inductor L is the coil of a d. c. relay, the relay will be picked up at the time instant when current I reaches its maximum steady value and will continue to hold until the switch subsequently is opened.

In Figure 5, capacitor C is charged to voltage level E from an external d. c. voltage source. Inductor L may be the coil of a sensitive d. c. relay. When the switch subsequently is closed, discharge current flows from capacitor C through the relay coil, L, and picks up the relay. As the capacitor discharges, this current decreases exponentially with time, as indicated by the accompanying curve. When the current drops to a critical value, the relay drops out. Like Figure 2, this circuit has the feature (advantageous in some applications) that all voltage is removed automatically from the timing capacitor when the circuit goes out of operation. In practical applications of the circuit, the capacitor is charged initially by switching it momentarily across the charging voltage source.

Applications of Time-Delay Circuits

Time-delay action of the simple R-C and R-L circuits described in the foregoing section may be utilized to obtain timed switching action. Either delayed make or delayed break is possible.

In Figure 6, the principle illustrated in Figure 5 is applied. Here, the inductive component is the coil of a sensitive d. c. relay, RY. When switch S is closed, current flows from voltage source E (battery or a. c.-operated power supply) through timing control rheostat R and the relay coil. The relay is picked up and capacitor C is charged at the same time. The relay will continue to be held-in as long as switch S is closed.

When switch S is opened, the voltage source will be disconnected from the circuit, but capacitor C will retain its charge. The capacitor then discharges through rheostat R and the relay coil at a rate determined principally by the values of R and C. When the capacitor discharge reaches the point where current through the relay coil is insufficient to hold-in the relay, the latter will drop out.

The resistance setting of rheostat R (for a given capacitance of C) will determine the length of the time in-

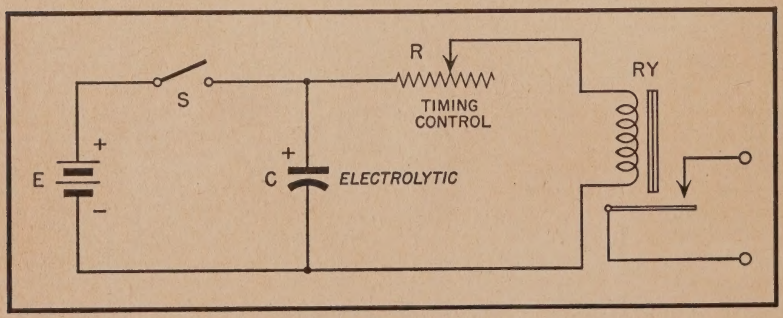

Fig. 6. Delayed-dropout non-electronic relay.

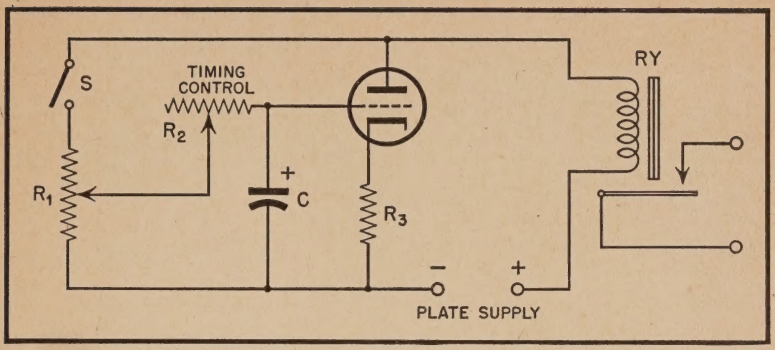

Fig. 7. Delayed-pickup electronic relay.

terval between opening of the switch and dropping-out of the relay. The rheostat dial accordingly may be graduated in seconds or minutes, as required. The resistance of the relay coil, together with the rheostat resistance, enters into the determination of the time interval. Sensitive milliampere-type relays have coils with comparatively high resistance. With some relays of this type, it may become necessary to connect timing rheostat R in parallel with the relay coil, instead of in series, in order to obtain short time intervals.

The potential of voltage source E must be high enough to pass full relay operating current through rheostat R and the relay coil in series.

Figure 7 shows a tube-type relay using the principle illustrated in Figure 3. In this arrangement, action is secured at some instant after the operating switch is closed.

The tube type, operating voltage, and circuit constants are chosen such that the static plate current of the tube is somewhat less than the operating current of the sensitive d. c. relay, RY. The total resistance of potentiometer R_1 must be high enough to prevent potentiometer current from picking up the relay. The setting of R_1 is adjusted to the voltage value required to pick up the relay. When switch S is closed, a positive voltage from potentiometer R_1 forces current through rheostat R_2 to charge capacitor C. The maximum, fully-charged voltage across capacitor C is reached at some instant after closure of the switch, and depends upon the time constant R_2C. When capacitor C becomes fully charged, the positive voltage presented to the grid of the tube causes an increase in plate current and this current increment picks up the relay.

When switch S subsequently is opened, the relay holds-in for an interval during which capacitor C discharges through R_1 and R_2 in series.

The delayed-dropout, tube-type relay circuit shown in Figure 8 utilizes the charged-capacitor principle illustrated in Figure 2. This arrangement is used frequently in electronic photo-print timers.

Pushbutton switch S normally is in position B. When S is thrown momentarily to position A, capacitor C is charged quickly by the d. c. voltage supplied by potentiometer R_1. When the pushbutton then is released and returns to position B, the fully-charged

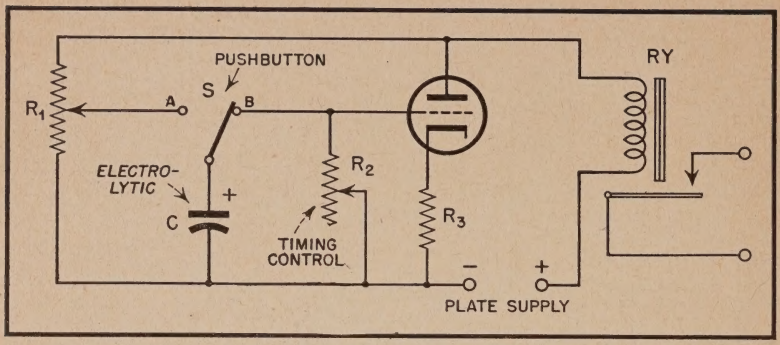

Fig. 8. Delayed-dropout electronic relay.

capacitor voltage is applied to the grid of the tube. This application of a positive potential to the grid increases the plate current which picks up the relay. The capacitor begins to discharge through rheostat R_2, however, reducing the positive grid voltage at a time rate governed by the values of C and R_2. When the positive grid voltage falls to a critical value, the plate current drops to a level insufficient to hold-in the relay and the latter drops out.

The tube type, relay, plate voltage, cathode resistor (R_3) and the total resistance of potentiometer R_1 are chosen so that the static plate current plus the steady current flowing through potentiometer R_1 will be slightly lower than the relay operating current.

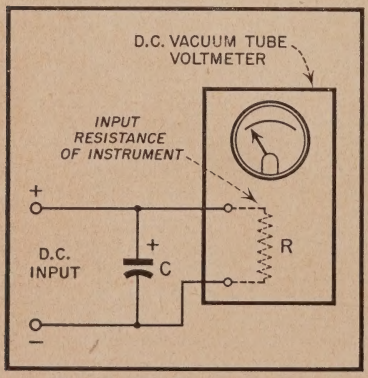

Fig. 9. "Holding" voltmeter.

Figure 9 shows a simple, but useful arrangement for "holding" momentary voltmeter deflections for a reasonable period of time until a careful reading can be taken.

A high-capacitance electrolytic capacitor, C, is connected in parallel with a d. c. vacuum tube voltmeter having an input resistance between 10 and 20 megohms. The unknown d. c. voltage is applied to the capacitor and voltmeter in parallel. The capacitor is charged quickly to the value of the applied voltage. When the applied voltage falls to zero, the capacitor retains its charge and maintains the deflection of the meter.

The capacitor discharges slowly through the input resistance, R, of the voltmeter. But since this resistance is very high, a high capacitance will hold the voltage deflection steady for an appreciable time. A 1000-microfarad electrolytic capacitor, for example, will keep a 17-megohm d. c. vacuum tube voltmeter constantly deflected for a minute or more.

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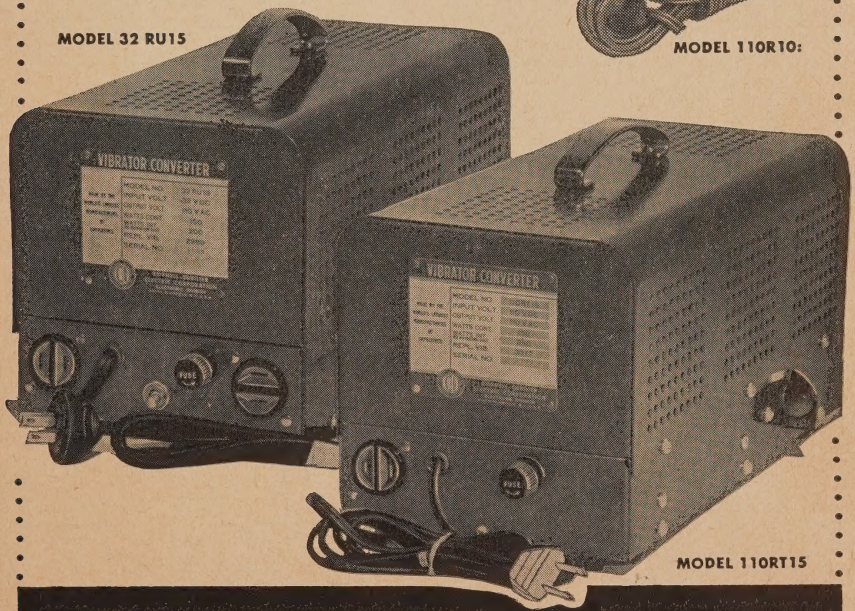

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WANTED—Rider TV Man. (all); Rider 11-22. State prices and cond.; Chanalyst. Harry Sherman, 11 Crehore Dr., Newton Lower Falls, Mass.

SELL OR TRADE—ARB rec. 195KC to 9.0 Mc. 3 years of IRE Proceedings. Want FM tuner, camera or guns. J. E. Gleason, Box 132, Lake Wales, Fla.

FOR SALE—Japanese 1 tube walkie-talkie with battery cables, headset, mike, antenna; covers 10M and up; like new with leather case; Navy TBY comp., like new. Fred Chapman, 910 Dashiell Rd., Falls Church, Va.

WANTED—Few wireless intercom units or circuit so we can build same. Ed. H. Showers, Sheridan, Leb. Co., Pa.

FOR SALE—Simpson 330 tube tester in oak case, exc. cond. $75 fob. or trade for TV set. Hein Radio Service, 418 Gregory St., Rockford, Ill.

FOR SALE—Hickok 610A and 288X sig. gen., both $150; Vomax mod. 900 $22.50; EICO mod. 425 scope $50; set handy talkies $35; Western Elec. hearing aid $25. Leonard E. Mumola, 850 40th St., Brooklyn 32, N. Y.

SELL OR TRADE—Complete set of crystals in case for SCR-610 or what have you. Interested in firearms, photography. H. Bernard, 3670 S.W. 9th Ter., Miami, Fla.

WANTED—829B and 3-4 Mc Command xmitter. G. D. Johnson, Pleasantville, Ia.

WANTED—For Boy Scout troop radio patrol, 2 meter RIG comp.; comm. rec., must be reasonable; tape recorder. Shacket, Scoutmaster, Troop 225, Box 131, Jamaica, L. I., N. Y.

TRADE—Olympic FM-AM tuner and radio, beautiful plastic cabinet, good tone, for Hallicrafter SX-42, or Browning RJ-20A or Radio Craftsman No. 10 tuner plus cash. Walter Bartell, 1107 N. Western Ave., Chicago 22, Ill.

TRADE—Hallicrafter S-41W for binoculars 7x50 or 6x30; must be in good cond. Send by insured mail. J. B. Mihelich, 113-A W. Hillcrest Blvd., Inglewood, Cal.

WANTED—Sprague To-3 Telomike cond. checker. Will pay cash or trade instruments. Leo Cammarata, 2225 W. 5 St., Brooklyn, N. Y.

SELL OR TRADE—TV set; record changer; tubetester; 6x30 binoculars; Edison home gramophone; 30 cylindrical records and tin horn. Want SX-28-HRO. Fred Simonian, 16D Ellis St., Lynn, Mass.

WANTED—3" pilot TV set; must be cheap. Wm. J. Schwallier, 406 Crestview Dr., Henderson, Ky.

SWAP—5 vol. set (1947) "Applied Practical Radio," Coyne; "Inside the Vacuum Tube," Rider; Astatic cartridge LQD-ITM, (78, 33 1/3). Want phototubes, channel 5 or 3 YAGI or what have you? Paul F. Bahr, PO Box 333, Marion, Ind.

FOR SALE—JK-38 keys $1.29; Supreme sig. gen. No. 576 $30, good cond.; Supreme tube and battery tester No. 589, $35. D. L. Johnson, 2504 N. Estrella, Tucson, Ariz.

WANTED—Radio interference and field intensity meter; working range 15 mcs to 400 mcs. Irwin Karabush, 4913½ W. Quincy, Chicago 40, Ill.

TRADE—1936 for 1937 Ford (Philco) control head with cables, or will pay cash. Steve Jackman, P.O. Box 141, El Cajon, Calif.

FOR SALE—Hewlett-Packard 400 A. AC VTVM, perf. cond; first money order for $100 takes it. A. Cooney, 215 N. Valencia St., Alhambra, Calif.

SELL OR SWAP—PE103, less base, like new; Jackson 3" scope, fair cond; RCA 30 MC fixed tuned AM police rec. with dynamotor; ARC-5, 3-4 MC xmtr, black crackle; Very light, 3 el. 10 MTR beam suitable field day. B. J. d'Adolf, Tappahannock, Va.

SWAP—Vomax 900-A in perf. cond. for 16 mm movie camera. Julio Bellber, Ruis Rivera 281, Rio Piedras, Puerto Rico.

FOR SALE—Hallicrafters S-41-G $30; Solar capacity analyzer CB-160 $25; Modern Radio Servicing, Ghirardi $3; Trouble Shooter's Man., Ghirardi $3; all in good cond. L. M. McGee, 501 East Wyatt, Herington, Kans.

FOR SALE—BC-348Q comm. rec. and BC-221 freq. meter with Tech. manuals, both for 110 V. AC $95 ea. or best offer or trade for Heathkit tube tester, scope, sig. gen. eqpt., etc. Andrew Tait, 4808 Flanders Ave., Kensington, Md.

FOR SALE—Schematic diagram, layouts, parts list; radio tube filament welder 25c; code practice oscillators 25c; 2 sta. intercom system 25c; phono amplifiers 2-3-4 tube 25c; auto elec. wiring system, schematic only 25c; all for $1. Messenger Workshop, 81 Mechanic St., Foxboro, Mass.

FOR SALE—Presto K8 recorder, exc. cond. $250; Shure 51 mike, like new $20. H. Dramen, 3938 Aragon Dr., San Diego 15, Calif.

FOR SALE—Fada FM Conv. mod. 795, cost $32.50; Superior X-Rayometer, volt-ohm meter, best offer. Want McMurdo Silver Sweep TV gn. mod. 911 in A1 cond. Will pay cash. Stevens Radio Shop, Raymond, N. H.

FOR SALE—Hallicrafter S40A, excellent condition, $65. Chas. Cerami, 146 Congress St., Newark, N. J.

FOR SALE—N.R.I. sig. gen. mod. 88 and N.R.I. sig. tracer mod. 33, perf. cond., instruction books included. Both for $70. William S. Smith, 49 S. Chester Pike, Glenolden, Pa.

SWAP—Sylvania tube tester, like new; comp. radio course by I.C.S.; quantity of Radio News C.A. Q.S.T. and other radio books for 270, Mauser action 300 Savage mod. 99R or binoculars. Frank J. Grabski, 119 Strauss St., Buffalo 12, N.Y.

FOR SALE—Oster 115 V. 60 cycle 1/30 hp reversible motor, like new; 1725 rpm constant speed. Perf. for beam antenna. $10 fob. Harold Cerny, 4225 Van Dyke, San Diego 5, Calif.

WANTED—N.R.I. Service Man. in good cond., Vol. 1. State price in reply. R&D Radio & Appliance Service, Dodgeville, Wisc.

SELL OR TRADE—Voltohmyst No. 195-A with RCA M1-8263 crystal probe; Rider Man. 1-15 inc., like new. Want wire recorder or will accept cash. S. R. Landis, 602 Schuylkill Ave., Reading, Pa.

SELL OR SWAP—5' scope similar to the Dumont mod. 224 in perf. cond.; electronic steel 8 string guitar, carrying case, amplifier. Swap for camera or electronic equipment. Ben L. Sandberg, 932 Westbourne Dr., Los Angeles 46, Cal.

FOR SALE—Tube tester, VOM, typewriter and other items; send stamp. John J. Trowbridge, 655 W 81st St., Chicago 20, Ill.

SWAP OR SELL—I.C.S. courses: Fund. of Radio, Everett; Radio Physics, Ghirardi; Radiotron Designers Handbook, RCA; Prin. of Radio, Henney; all like new. Want guitar pickup, amplifier or cash. Emanuel Weiner, 2476 W. 77th Ave., Philadelphia 38, Pa.

SELL OR SWAP—BC 412B radar oscilloscope and Weston mod. 772 analyzer with 5000 V. probe, and other items; send for list. Want power tools, metal cutting lathe, etc. Bernard Soroka, 5341 Cordelia Ave., Baltimore 15, Md.

SELL OR SWAP—What have you for over $100 worth of radio parts? Send for list. C. D. Bufano, 185 N. 15th St., Bloomfield, N. J.

FOR SALE—55 Solotone coin operated boxes with clock, speaker and output transformer; 24 record changer. Richard Rice, 816 W. Maple, Champaign, Ill.

SELL OR SWAP—Voltohmeter, sig. gen., radio chassis in good shape less tubes. Want .22 cal. Winchester, wrist watch, camera with lenses f2.9 or f3.5. Write for list. J. Bondaruk, 410 E. 13th St., New York 9, N. Y.

FOR SALE—Auto radios: Buick 1949-'51, $35; Olds 1941 $20; Pontiac 1941 $20; others $10 up. Also Motorola tuning heads. T. J. Ambrose, 211 Farren Ave., New Haven 13, Conn.

FOR SALE—Solar CCB cond. analyzer $20; Sparx 905 sig. tracer $20; both A-1. Butler C. Clave, Rt. 2, Petoskey, Mich.

TRADE—Comp DeForest Radio and TV course for model electric train, comp. with tracks, etc. Bruce Psimer, 17486 St. Aubin, Detroit 12, Mich.

SELL OR TRADE—723 A/B reflex Klystron, slightly used $7.89 or trade for CAY-52ACV ASB-7 transmitter. Joseph Bentley, 247 Ivan Ct., Salt Lake City, Utah.

FOR SALE—2 Supreme mod. 542 multimeters not in working cond. Want comm. rec. or what have you? Norman I. McHale, 77 Turner Ave., Buffalo 20, N. Y.

TRADE—Hand winding Seth Thomas metronome. Will swap for a volt-ohm milliammeter. Anthony Bruno, 6812 11th Ave., Brooklyn 19, N. Y.

WANTED—RCA 96K6 chassis; Delco sig. seeking rec. or tuner section in any cond. State prices and cond. Will swap radio parts, magazines, books. A. T. Hennek, 204 Range St., Mankato, Minn.

WANTED—Hickok mod. 505A scope; crystal calibrators no. 157 and 9572 for RCA Signalyst no. 161. For Sale—Solar mod. CE-160 capacitor analyzer, like new, $25. Paul Capito, 637 W. 21 St., Erie, Pa.

FOR SALE—Meissner FM tuner, A1 cond. Make offer. S. Harlan Herr, Paradise, Pa.

FOR SALE—Vomax mod. 900, A1 cond., $30. Payne's Radio Shop, 410 S. 2nd Ave., Washington, Iowa .

FOR SALE—2 Philco No. 901 4-station intercoms with No. 902 stations; 2 Ferranti potted 500 CPS high pass filters; Raytheon VR-5 volt. reg. 500 W. 110 V. 1%; Stancor U-131 power pack 6 V. 7.5 A. DC adjustable. E. Bayard Toulmin-Rothe, 117 Aiken Ave., Rensselaer, N. Y.

TRADE—ATR 6-RSC 6 V. input, 60 cy. output, 110 AC inverter for a powered jig saw. Selcraft, Box 394, Spring Valley, N. Y.

FOR SALE—RCP mod. 8773 Servishop; Heath sig. tracer; Supreme tube and set tester; 2 table radios; 2 auto radios; Pilot FM converter; Meissner rec. T10-1199 kit. W. E. Fuller, 4620 Stafford Rd., Lansing 10, Mich.

SALE OR SWAP--Weston mod. 777 tube-tester, like new. Best offer ov $50, or trade for RCA WV97A Senior or WV77A Junior Voltohmyst. B. B. Heigh, 45 S. Elliott Pl., Brooklyn 17, N. Y.

SALE OR TRADE—QST 1922 to 1940, about 100 copies; misc. ham and service parts. Want late radio magazines, manuals, year books, etc.; inside mikes, electric drill and sander. E. Carter, 814 Craig St., Schenectady, N. Y.

SALE OR SWAP—Professional N.R.I. sig. tracer mod. 33, exc. cond. Want comm. rec. or cash. George G. Lau, 147 N. 3rd St. rear, Hamburg, Pa.

FOR SALE—Gardiner automatic tape sender with 14 tapes, variable code speed S 4 through 60 wpm, perf. cond., with operating instructions, $16. Thomas Korn, 4412 Milwaukee Ave., Chicago 30, Ill.

TRADE—Watch parts, movements, tool kit; Want 16mm sound projector or 6" metal working lathe or larger. Nash Radio Service, 211 W. 6 St., S. Sioux City, Neb.

WANTED—Howard type 650 pre-amplifier. State cond. and price. J. E. Carr, 250 S. 44th St., Philadelphia 4, Pa.

WANTED—Married man wants position in radio servicing or allied field; 4 yrs. radio exp.; finished 2 radio courses, 3 in electricity and 1 in advanced electronics. Robert Clary, RFD 3, Flemingsburg, Ky.

FOR SALE—Westinghouse FM and AM radio mod. H-182, perf. cond., $20. M. Francis, 10244 Bensley Ave., Chicago 17, Ill.

FOR SALE—Supreme mod. 592 multimeter; Earl Webber sig. gen. 90 kc to 60 mc, accuracy guaranteed. Both units $30 or meter $25 and gen. $7.50. Jack's Radio & TV, 508-10 Central Ave., Bedford, Ia.

FOR SALE—Good amateur station, Welco 50 W. phone transmitter, Hallicrafter SX 25, BC459 VFO, and if desired 10 meter beam. Sell all or part very reasonable, condition guaranteed. L. E. Halsted, Arvada, Colo.

FOR SALE—Rider Man. vol. 12 $7; 1941 Radio Circuit Man. $6, both prepaid, good cond. Carver Radio Service, 207 S. Meridian St., Ravenna, Ohio.

WANTED—RCA coin operated radios. State quan. and price; interested in other makes. E. J. Scroggin, 702 Douglas St., Lee's Summit, Mo.

FOR SALE—2 Jensen Hypex speakers $35 ea.; 2 Jensen SPH81 projector speakers $40 ea.; Navy 6V6 P.P. parallel 30 W. amplifier $25; 1 mike $25. L. B. Hosken, 2802 Ezekiel Ave., Zion, Ill.

SALE OR TRADE—Triplett 2432 sig. gen., Supreme 589A tubetester, both like new; Speed-o-Print mod. L automatic feed rotary duplicator, 4000 copies hour, like new, reas. Want FM-AM radio. Sy Genser, 2236 82 St., Brooklyn 14, N. Y.

FOR SALE—SCR 522 unconverted, exc. cond. $30; 110 V. AC 1400 W. gas gen., like new $100; transformer 4400 V. ct, 500 ma. $25; Supreme sig. gen. and Weston tube tester both $15. Milton Wendroff, 1745 E. 16 St., Brooklyn 29, N. Y.

SELL OR SWAP—SCR 522, like new, comp $50; demodulators, remote control system M-2, comp., $2 or three for $5. Want meters, tubes. P. W. Kilpatrick, 1030 Curtis St., Albany 6, Calif.

FOR SALE—Radio & TV Sales & Service, estab. over 6 yrs., same owner; pretty well equipped, test equip., shelving, benches wired, Rider and Sam Mans. Has good reputation,low rent, liv. qtrs. Hemp's Radio & TV, 6309 York Blvd., Los Angeles 42, Calif.

WANTED—Factory-made audio oscillator, variable freq., to check speakers direct. Calibration accuracy no object. Ernest Marks, Macon, Mo.

SALE OR TRADE—Sams Photo Facts, vols. 11-14 $40 fob, or will trade for Riders 20-22. All vols. in perf. cond. Randy's Radio Service, Carrington, N. D.

SALE OR TRADE—6 tube triode Consumers Research amplifier comp. Sell reasonable or trade for Western Electric speaker 728B. Also have GI constant speed 33⅓ turntable mod. CX. G. J. Reichert, 4833 S. Upton Ave., Minneapolis, Minn.

FOR SALE—GE 0-1 amp. R.F. ammeter, 2½" round bakelite case $5 postpaid. L. Weinreb, 151-09 34th Ave., Flushing, L. I., N. Y.

FOR SALE—Kay Mega, match mod. 1, used very little, exc. cond. $550. Andrew Corp., 363 E. 75th St., Chicago 19, Ill.

FOR SALE—Two Electro-Voice microphones; Cardyne II dynamic and Cardax 950 crystal, ea. with 25' cable and desk stands, both for $55. R. S. Eastman, 1403 Ave. Y, Brooklyn 35, N. Y.

WANTED—Top cash or trade for APR-4 units and parts; Microwave test eqpt, ARC-1, ARC-3, ART-13, etc.; TS-34 and other TS; General Radio, L&N, Boonton, Ferris, etc. items. Have TV and ham equipment. Littell, Farhills Box 26, Dayton 9, Ohio.

WANTED—QST magazines, Rider and Sam Mans.; sig. tracer, test eqpt.; surplus transmitters and rec's. Will trade antique tubes, Mossberg spotting scope, American Rifleman, Minicam magazine, etc. F. G. Wadsworth, 1528 N. Frankfort, Tulsa 6, Okla.

SELL OR SWAP—BC312 with RA20 AC supply $65; Triplett 2400 VOM; Raytheon VR-6113, QST. Jan. '37 to Jan. '49. Want latest Heathkit, scope and VTVM in kit form. M. J. Marshall, 455 Washington Ave., Dumont, N. J.

WANTED—Prop pitch motor, ½hp, 7000 to 1 ratio, 1¼ rpm. Will pick up in Chicago area. Elston Swanson, 1529 N. Laramie Ave., Chicago 51, Ill.

SALE OR SWAP — Superior mod. 1240S Emission tube tester $10; Heathkit oscilloscope 5", mod. O-2 $25; Abott trans-receiver $15; Jos. F. Dineen, 9 Winter Terr., Westwood, Mass.

FOR SALE—Capacitor analyzer mod. 50 CD in good cond. $25. Agostino Palermo, 223 S. Winebiddle Av., Pittsburgh 24, Pa.

FOR SALE—Transformers UTC S-49, Stancor P-3060; chokes Stancor C-1702, C-1404, C-1413, all in exc. cond. $35. D. S. Bolaffi, 551 Fifth Ave., New York, N.Y.

FOR SALE OR TRADE—Last three newly assembled 1951 0-6 Heathkit 5" oscilloscopes, and V-4 VTVM, for best offers in cash or tubes. Robert O. Burns, 28 N. Highland Ave., York, Pa.

TRADE—Collector's item, mod. 1860 .50 cal. Spencer repeating rifle, for set of Sams Photo Facts, or 25 W. P.A. system for sound truck, 110 V. AC and 6 V. DC. Frank Henrikson, 1615 S.E. Alexander, Pendleton, Ore.

SALE OR TRADE—Clearing out 30 year accumulation of radio magazines, parts for old, obsolete radios. Many serviceable parts offered. Pace's Radio Service, PO Box 611, Vicksburg, Miss.

SALE OR TRADE—Analyst, Meissner mod. 10-1154 good working cond.; 2 post Seeburg record changer chassis, perf. cond. 78 rpm, 10" or 12" records, needs crystal. L. S. Chapman, Belzoni, Miss.

FOR SALE—Precision E-200 sig. gen., perf. cond. Best offer over $30 takes it. Emil Altenbach, RR No. 7, Kern Dr., Cincinnati 11, Ohio.

WANTED—NRI Service Man Vol. 2; testing equipment; RCA 630-TS TV set. State cond. and price. H. G. Radcliffe, 1013 High St., Petersburg, Va.

FOR SALE OR TRADE—Hickok 510-X like new $30; Pilot TV 37 with 5" bubble $45; Eastman Kodak enlarger $70; Eastman projector and beaded screen $25. C. Bernard Smith, 920 S. Euclid, Pasadena 5, Calif.

SELL OR SWAP—125 W. speech amplifier and modulator $55; Electrovoice microphones, mod. 910 $10, mod. 630 $15; bug $7; Millen R-9 $12. Want 8 or 16mm movie eqpt. or 35mm camera, slide projector or what have you? David D. Bulkley, 1825-C Palmer, Larchmont, N. Y.

FOR SALE OR TRADE—Eico mod. 221VTVM like new, for sweep sig. gen. or scope or for cash. H. Levine, 72 E. 96th St., Brooklyn 12, N. Y.

FOR SALE—Bausch-Lomb TV projection lenses $30; adjusting ring; mounted on amphenol sheet $5; both $33. Have other H.V. projection components for sale. H. Bergh, 1583 E. 96th St., Bklyn. 36, N. Y.

TRADE—BC-348-Q rec. 115 V. AC, exc. cond., for Admiral TV. Prefer 20 x 12 model. W. D. Hileman, 334 E. 8th St., Bloomsburg, Pa.

SELL OR TRADE—NRI tester without batteries $8; NRI 5 tube radio with cabinet $20; Syncro sharpener $5. Will trade for binoculars, telescope, radio or machine shop equipment. Al Beavin, RFD Fair Haven, Vt.

SELL OR SWAP—Precision sweep sig. gen. E-400 $98; Rider Mans. all like new 6, 8-13 $75. S. W. Kovacs, 417 Vannest Ave, Trenton 8, N. J.

SWAP OR SELL—Sig. tracer built from Popular Mechanics radio blueprint R-380, comp. Want VTVM or radio parts. Edwin Loys Futch, RFD 1, Farmerville, La.

WANTED—Sweep gen. such as Silver 911 or what have you. Offer in trade the following Masco musical instrument amplifier, 16mm movie projector, field strength meter, disc recorder and play back, accordion, crystal mikes, tubes. Want double stage TV booster. John Arnold, Box 84, Bluffs, Ill.

FOR SALE—Hallicrafters T-54 7" TV, $55; Rek-O-Kut LP-35 12" turntable $35; Zenith Trans-oceanic portable $100; Shure 51 Sonodyne dynamic mike $20, all fob, all exc. V. R. Hein, 418 Gregory St., Rockford, Ill.

FOR SALE—Radio City Prod. VOM mod. 423, in hardwood portable case, with operating instructions. Exc. cond., sac. $25. Milton Maultasch, 535 Grand St., Brooklyn 11, N. Y.

FOR SALE—Shure "Statoliner" dynamic mike comp. with cable and desk stand adjustable 8" to 13", A1 shape, $15. Otto Pollei, Jr., 1944 Roanoke, Louisville 5, Ky.

FOR SALE—Cathode ray tubes: 5BP1 or 5BP4 at $2.50 ea. cod. V. Kozma, 1665 Stadium Ave., New York 61, N. Y.

WANTED—Cabinet for general radio mod. 5A5. Ben's Radio, No. Tonawanda 2, N. Y.

FOR SALE—Mobile amplifier, Bogen HX632 32 W. 4 University reflex horns; 4 University PM dynamic units; Precision EV10 VTVM. Write for prices. John J. Levine, 15-17 Kelley Sq., Worcester 4, Mass.

WANTED—Duplicate power transformer for Atwater Kent radio, chassis mod. 76. Duke, Columbia Rd., Marshfield, Mass.

FOR SALE—Radio chassis, all makes at sacrifice prices; 10" dynamic speakers, and many other items. Write for details. Goldstone Radio, 1279 Sheridan Ave., Bronx 56, N. Y.

SELL OR TRADE—VOM Simpson 260, Scott marine rec., 10" table TV, Stromberg Carlson. Need audio gen., oscilloscope, VTVM of good make, etc. John Pellock, 614 W. North, Decatur, Ill.

WANTED—35mm enlarger. Will trade sig. gen. multitester, or radio parts. Wallace G. Kennedy, 470 Cleveland St., Bklyn. 8, N. Y.

WANTED—Tape recorder accessories such as mikes, tape splicers, microphone mixer, etc. Also TV magnifier for 10" screen. Norman LaCroix, 21 Mavis St., Pawtucket, R. I.

SELL OR TRADE—Fada FM tuner, LP record changer, cheap ham rec. J. Mrofchak, R 4, Lapeer, Mich.

SALE OR SWAP—Diamond phono needle for use with Edison records with vertical recording. J. R. Blondin, 214 W. 2nd St., Mt. Carmel, Pa.

FOR SALE—Rider Mans. Abridged, 1-5, 9, 10-13, 15. Will consider best offer or trade for camera equipment or guns. M/Sgt. Melvin W. Nelson, 60th Ord AAA, Aberdeen Proving Grounds, Md.

WANTED—Hallicrafter Rec. mod. SX62 or National mod NC125 in good cond. State lowest price. M. Petko, 2033 Dennie St., Phila 40, Pa.

SALE OR TRADE—BC 929 3" scope, good for conversion to test equipment (with diagram); 2 BC1206 rec., low freq.; Tele-Sweep sweep gen. for TV and FM alignment. Edward Tanrath, 2631 S. Drake Ave., Chicago 23, Ill.

FOR SALE—BC1068 2 meter rec.; 7" Philco TV, sound powered handsets, Alliance TV rotator, Stromberg Carlson all band rec. (10 tube), power supplies, development TV chassis and receiving and transmitting parts and tubes. Cy Harris, 1223 Schenectady Ave., Brooklyn, N. Y.

WANTED—Table model radios. What have you? State cond. and price. J. R. Lambert, 8474 Sunset Blvd., Hollywood 46, Calif.

FOR SALE—Hickok 195-B oscilloscope, like new, $125 or best offer. S. K. McGill, 723 Virginia Pl., Hapeville, Ga.

FOR SALE—Hallicrafters SX-25 less speaker, $35 fob. W. Richman, 3438 90th St., Jackson Hts. 72, L. I., N. Y.

TRADE—ATR inverter, 6 V. DC to 110 V. AC. Want good bench saw or jigsaw. H. Seligson, New Hempstead Rd., New City, Rockland Co., N. Y.

SELL OR TRADE—NRI '51 Radio, TV, Microwave Comm. course comp. L. J. Pfandtner, 3230 Lake Ave., Baltimore 13, Md.

WANTED—APR-4 tuning units TN-16 and TN-17. Will trade tubes, carbon mike or other radio supplies. J. B. Mihelich, 113-A W. Hillcrest Blvd., Inglewood, Calif.

FOR SALE OR TRADE—Crosley 10" TV mod. 9-408 (630TS circuit) in good cond. for Sams Photofacts in good cond. Harold C. Morris, 404 Second St., Shenandoah, Va.

WANTED—Precision E 210C sig. gen. in good cond. J. Raisman, 1751 Georges Lane, Philadelphia 31, Pa.

WANTED—10GP4 or 10HP4 picture tube in good cond. magnifying lens for TV. R. Amos, Box 40, Rio Grande, Ohio.

FOR SALE OR SWAP—3 PH plating transformer and rectifier; welding outfit for what have you. Modern TV Service, 185 N. 15th St., Bloomfield, N. J.

WANTED—Tape recorder. Quote lowest price. M. Metz, 2174 N. Melvina Ave., Chicago 39, Ill.

FOR SALE OR TRADE—2 Presto K recorders (1 amp. and 1 speaker, 2 cutters and turntables); 28 V. DC army wire recorder (no playbacks); old television chassis (no tubes). Want microscope; 16mm movie camera. Herbert Hoch, 418 E. 53rd St., Brooklyn 3, N. Y.

FOR SALE OR TRADE—NRI power supply and VTVM, perf. cond., with instruction books. Need tube tester. L. T. Suss, 27 N. William St., Baldwin, L. I., N. Y.

FOR SALE—Exceptional opportunity to buy 20-yr. est. radio-TV store comp., inc. 3 rm. apt. Whole outlay can be made back in 8 months. Finster, 601 Marcy Ave., Brooklyn 6, N. Y.

WANTED—E-200-C sig. gen. and good FM-TV sweep gen. or H129-X rec. J. R. Driver, 6419 Fitzhugh Ave., Richmond, Va.

WANTED—Complete Instructions for building Tech-Master mod. 630 D19 "Deluxe" or mod. 630 S19 "Standard" TV rec. For sale BC-342N comm. rec. with speaker $75. J. W. Yasi, 424 Eastern Ave., Lynn, Mass.

WANTED—Hallicrafter S-29 Sky Traveler portable radio; cash, doesn't have to work. State cond. and price. E. S. Bednar, 81 Lincoln Ave., Carteret, N. J.

FOR SALE—Meter for I-56 test set, Triplett comb. tube tester, VOM, etc. $10. Herbert Greenberg, 775 E. 52nd St., Brooklyn 3, N. Y.

WANTED—Transceiver transformer (Inca 1-45) as in 1946 Radio Amateur's Handbook, pp. 361, 362. Joseph Syczyo, Jr., 1110 Lansing St., Utica 3, N. Y.

FOR SALE—Army surplus PU-8 gasoline motor driven gen. unit, 110 V., 1400 W., 400 cycle and 28 V. DC, 400 W. with spare parts, like new $100 fob Bklyn. Milton Wendroff, 1745 E. 16 St., Bklyn., 29 N. Y.

FOR SALE—Hickok 305 scope like new $75; Philco tube tester $17.50; 2 Jensen 18" speakers AC field built in $35 ea.; Motorola VT107 table set 8" speaker, good cond. $100. Eilers' Radio & TV, Gladbrook, Iowa.

FOR SALE—Precision tube tester and VOM mod. 920 $25; Precision sig. gen. mod. E-200-C $35, perf. cond. Will sell both for $50. C. W. Barnes, Jr., Apt. 228 R, Flavet 3, Gainesville, Fla.

SELL OR TRADE—Westinghouse AC type F.H.T., ¼ hp., 60 cycle, 1750rpm, amp 4.6 cont. duty. Want good FM rec. Also have Precision E-200 sig. gen. mod. by mfr. to E-200-C. T. M. Olsen, 745 E. 242 St., Bronx 70, N. Y.

FOR SALE OR SWAP—810's, 813's, 814's transformers, meters, etc. Want comp. mobile equip. and grid-dip meter. What do you have? R.V. Rosellini, 2619 S. Gaylord, Denver, Colo.

SELL OR SWAP—National Schools Correspondence Course, comp. Want Heathkit VTVM, scope, cash or ? M. Crabb, P.O. Box 82, Vestal, N. Y.

SELL—2 wireless phono oscil.; 3 hp engine; 35mm MP camera; key bug; disc recorders; projection TV; 16mm projector and screen; 10 KVA transformer; Spanish language recs., etc. Earl P. Carter, 112 Cedar Ave., Pitman, N. J.

FOR SALE OR TRADE—Rider Man. 1, 2, 4, 5, and 6 and index; RCA low. imp. velocity mike. Want low cost FM-TV sweep gen. and VTVM. F. J. Goldwater, 572 Broome St., N. Y. 13, N. Y.

SELL OR TRADE—Mark II tank trans.-rec. like new, comp. Want scope, or $25 FOB Phila. Arthur D. Fisher, 600 W. Roosevelt Blvd., Philadelphia 40, Pa.

WANTED—10" or 12" TV. Please state lowest price. No cards please. Also have many articles to trade for a good camera or? M. Gianfrocco, 80 Appleton St., Providence 9, R. I.

FOR SALE OR TRADE—Comp. set parts inc. wired power chassis, crystal mike in perf. cond. from NRI Comm. Course; also comp. set textbooks, FOB. Cecil C. Roberts, 342 W. 65th St., Chicago 21, Ill.

FOR SALE—Rectifier 115 V.A.C. to 12-14 V. D.C., uses two 6 amp. bulbs; 2 W. E. 555 Horn units; 3 W. E. 3 A. P. E. cells. Herman Polier, P.O. Box 702, Dover, Del.

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FOR SALE—3 tube all-channel TV booster $8.50; BC-459 with tubes and xytal $12.50; 2 852 tubes $5 ea.; make offer on 2 good comp. BC-659-K's with 6 V. power sup. K. E. Yerkes, 1238 Blewett, San Jose, Calif.

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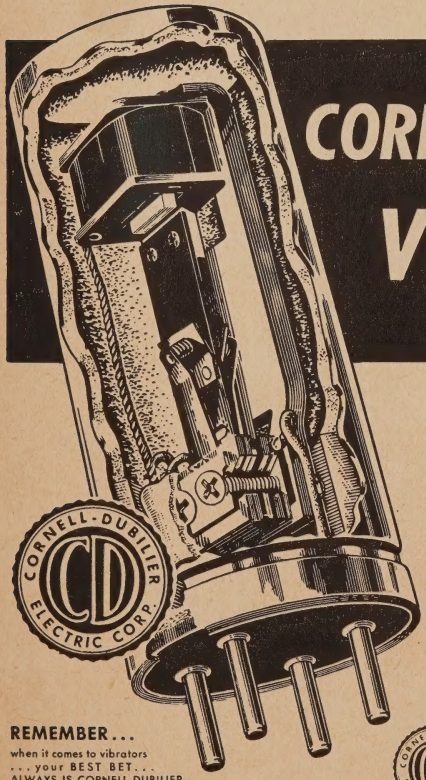

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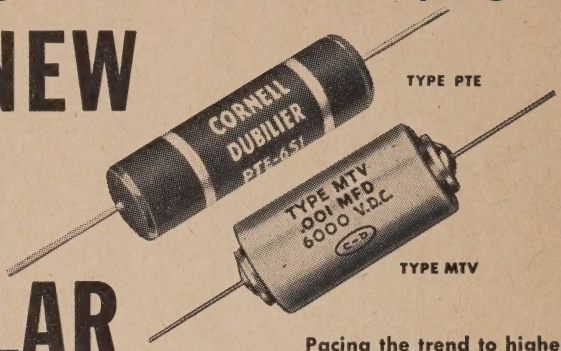

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